# Massachusetts Department of Public Health

# 2006 MASSACHUSETTS ARBOVIRUS SURVEILLANCE AND RESPONSE PLAN

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## Executive Summary

The 2006 Arbovirus Surveillance and Response Plan provides surveillance and phased response guidance for both the West Nile virus (WNV) and eastern equine encephalitis (EEE) virus. This document replaces two previous documents, the "Massachusetts Surveillance And Response Plan For Mosquito-borne Disease" (2001) and the "Vector Control Plan to Prevent Eastern Equine Encephalitis" (1999). The current document incorporates and updates both of these.

The 2006 plan is the result of analyses of additional surveillance data collected in Massachusetts and the U.S. since WNV first appeared in the United States. The purpose of the plan is to provide guidance on operational aspects of surveillance and response by state and local agencies with responsibility for the prevention of mosquito-borne disease. The Department of Public Health will continue to seek advice from its partners and collaborators and modify the plan, as appropriate. This document is open to continual review and evaluation. Information is provided to guide planning and actions to reduce the risk of human disease from EEE virus and WNV. Key objectives contained in this plan provide for the monitoring of trends in EEE virus activity and WNV activity in Massachusetts; the timely, information on the distribution and intensity of WNV and EEE virus in the environment; the laboratory diagnosis of WNV and EEE cases in humans, horses and other mammals; effective communication, advice and support on activities that may reduce risk of infection. This document provides information about EEE and WNV disease; program goals, and specific guidelines for mosquito, avian, equine and human surveillance. Additionally, this document provides guidance for the dissemination of information, including routine information, media advisories of positive EEE virus & WNV findings in birds and mosquitoes; as well as public health alerts related to positive EEE & WNV human cases.

Recommendations regarding the WNV phased response plan appear in Table 1 and incorporate components presented in the "Massachusetts Surveillance and Response Plan for Mosquito-Borne Disease", May 2004; as well as those presented in the CDC document, "Epidemic/Epizootic West Nile Virus in the United States: Guidelines for Surveillance Prevention, and Control", 3rd Revision, 2003. Recommendations regarding the EEE virus phased response plan appear in Table 2 and incorporate information provided in the MDPH document, "Vector Control Plan to Prevent Eastern (Equine) Encephalitis", 1991; as well as analyses of additional surveillance data collected in Massachusetts since that time.

## I. INTRODUCTION

The Massachusetts Department of Public Health (MDPH), in collaboration with regional mosquito control projects (MCPs), conduct surveillance for mosquito-borne viruses that pose a risk to human health. The Mosquito-borne Disease Surveillance Program (MDSP) tests mosquitoes, birds, veterinary specimens from horses and other mammals, and humans for evidence of infection; identifies areas of disease risk; provides information to guide decision-making to reduce the risk of disease; and informs the public of where and when there is an increased risk of infection. The MDSP currently focuses on West Nile virus (WNV) and eastern equine encephalitis virus (EEE virus) which are found in the local environment and are capable of causing serious illness and death in humans and horses (EEEV / WNV) and birds (WNV).

The 2006 Massachusetts Surveillance and Response Plan for mosquito-borne diseases is based on a comprehensive plan developed for WNV in 2001 in collaboration with local health agencies, other state agencies, academic institutions, the Centers for Disease Control and Prevention (CDC), interested groups and individuals. Surveillance for EEE virus began in the 1950's and has continued since that time. MDSP began monitoring for WNV following a 1999 outbreak of human WNV disease in the New York City area, the first known occurrence of this disease in North America. WNV was identified in birds and mosquitoes in Massachusetts during the summer of 2000 and has been found during each consecutive season. In order to manage the complexity of the human disease risk posed by this virus, MDPH convened four workgroups that advised MDPH and promoted collaborative efforts among local health departments to reduce the transmission of WNV.

The updated 2006 plan is the result of analyses of surveillance data collected in Massachusetts and the U.S. since WNV was first identified in the United States. The purpose of the plan is to provide guidance on operational aspects of surveillance and response by the state and local agencies with responsibilities for the prevention of mosquito-borne disease. MDPH will continue to seek advice from its partners and collaborators and modify the plan, as appropriate. This document is open to continual review and evaluation with changes made when there is opportunity for improvement.

## II. DISEASE BACKGROUND

The two principal mosquito-borne viruses (also known as arboviruses, for **ar**thropod-**bo**rne viruses) recognized in Massachusetts and known to cause human and animal disease are eastern equine encephalitis virus (EEE virus); with the first human cases identified in both the United States and Massachusetts in 1938, and West Nile virus (WNV), with the first human case identified in the United States in 1999 and in Massachusetts in 2001.

### Eastern Equine Encephalitis Virus

Eastern equine encephalitis virus (EEE virus) is an alphavirus enzootic in some passerine bird species found in fresh-water swamp habitats. The virus is transmitted among wild birds in these areas primarily by *Culiseta melanura*, a mosquito species that feeds predominantly on birds. This mosquito-borne virus has a cycle of natural infection among bird populations with occasional ''incidental" symptomatic infections of humans, horses and large domesticated birds (emus, ostriches, etc). Prevalence of infection among birds is related to the prevalence in bird-feeding mosquitoes. When infections become more prevalent among birds, infection rates may rise in mosquitoes that feed indiscriminately on birds and other animals. Thus, infection within bridge vectors seems to enhance the risk of infection to people.

Eastern equine encephalitis is a serious disease (30-70% mortality and lifelong neurological disability among many survivors) that occurs sporadically in Massachusetts. Historically, clusters of human cases have occurred in cycles lasting 2-3 years, with a hiatus of 10-20 years between outbreaks. In the years between outbreaks, isolated cases may occur. Although EEE virus may be detected in nature each year, few or no human cases of EEE may result.

Outbreaks (involving two or more human infections associated temporally and spatially) occur with the convergence of several factors. A major factor that affects the risk of disease in humans is the prevalence of immunity to EEE virus in the birds that serve as the enzootic reservoir of the virus. EEE virus infection in passerine birds usually results in a mild infection. Following infection, birds become immune to EEE virus and will not harbor the virus. Following a year of increased viral transmission, the prevalence of EEE immunity in birds increases and in subsequent years EEE virus may not be able to spread rapidly among these reservoir hosts. Thus, elevated levels of herd immunity in birds reduce the spread of EEE virus in the bird-mosquito-bird cycle, which reduces the chance of incidental infections in humans.

Other major factors that affect the risk of EEE virus infections for humans are the abundance of specific kinds of mosquitoes at critical periods of the transmission season, groundwater levels and the timing of rainfall and flooding during the mosquito season. Participation in outdoor activities and the use of personal protective measures (e.g., avoidance of mosquitoes, use of repellent) by people may reduce the risk of exposure and infection.

The risk of EEE virus infection in humans varies by geographical area in Massachusetts, as well as in the United States. EEE is more prevalent in areas that support nesting of dense populations of passerine birds and have favorable breeding conditions for the enzootic vector. In Massachusetts, these areas consist mainly of large wetlands containing mature white cedar and red maple swamps that are more common in southeastern Massachusetts. The majority of EEE cases have occurred in Norfolk, Bristol, and Plymouth counties with some cases also occurring in Middlesex County, rarely in Essex County and very rarely in Worcester County or further west. Historically, Cape Cod and the Islands of Martha's Vineyard and Nantucket have not had human cases of EEE.

The Massachusetts Department of Public Health, with U.S. CDC funding, initiated a field surveillance program in 1957 following a 1955-56 outbreak of EEE. The purpose of the program was to gather data to aid in guiding prevention and risk reduction of this disease. Outbreaks of human EEE disease in Massachusetts occurred in 1938-39 (35 cases, 25 deaths), 1955-56 (16 cases, 9 deaths), 1972-74 (6 cases, 4 deaths), 1982-84 (10 cases, 3 deaths), 1990-92 (4 cases, 1 death), 2004 -05(8 cases, 4 deaths).

The risk of infection in humans is a function of exposure to infected human-biting mosquitoes. Certain kinds of mosquitoes are highly selective as to the host they will seek and feed upon. *Culiseta melanura* (*Cs. melanura*) mosquitoes feed primarily on birds and are recognized as the predominant vector of EEE virus among the passerine birds that are the reservoir of the virus. Thus, the force of enzootic EEE virus transmission is correlated with the abundance of the enzootic vector. If the herd immunity level against EEE virus of these birds is high (i.e. few susceptible birds) due to prior years exposure, then there is little opportunity for the virus to perpetuate or amplify within the bird population. When herd immunity is low, EEE virus infections can spread more rapidly and more widely among the birds. This condition may enhance the potential for transfer of EEE virus to humans by a bridge vector mosquito, i.e., a species that is indiscriminant and will feed on birds or humans, such as *Cq. perturbans, Oc. canadensis, Ae. vexans* and *Culex species.*

Long-term weather patterns during the fall and winter that include high ground water levels and snow cover may enhance survival of *Cs. melanura* larval populations. The abundance of these larval populations may serve as an early indicator of potential risk later in the year.

Mosquito life cycles and abundance of mosquitoes involves multiple factors. It is not currently possible to predict either the abundance of mosquitoes or the risks of encountering an infected vector later in the season. The best control approach to reduce these vectors must consider multiple factors. One approach calls for beginning integrated pest management (IPM) control activities early in the season and targeting human biting vector species. Such an intervention might be considered in a year when the risk of EEE virus spread appears significant.

## West Nile Virus

Following the identification of WNV in birds and mosquitoes in Massachusetts during the summer of 2000, MDPH arranged meetings of local, state and federal officials, academics and the public to develop recommendations to improve and strengthen key aspects of the state plan for mosquito-borne virus surveillance and prevention of mosquito-borne disease. Four workgroups addressed issues of surveillance, risk reduction interventions, pesticide toxicity and communication.

WNV infection is often fatal in certain kinds of birds, especially American crows, and causes significant mortality in other kinds of birds (such as blue jay). Confirmation of WNV in dead birds provides sentinel information useful for assessing risk of human WNV infections. WNV infection may be asymptomatic in some people, but it leads to morbidity and mortality in others. WNV causes sporadic disease of humans, and occasionally results in significant outbreaks. About 3000 human cases (nationwide) of WNV neuroinvasive disease (West Nile meningitis and West Nile encephalitis) and WNV fever were reported to the CDC in 2005.

WNV affects the central nervous system. While symptoms may vary, about one in 150 people infected with WNV will develop severe illness. Severe symptoms can include high fever, headache, neck stiffness, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, and paralysis. These symptoms may last several weeks, and some neurological effects may be permanent. Up to 20 percent of the people who become infected will display symptoms that can include fever, headache, and body aches, and sometimes swollen lymph glands. Symptoms can last for as short as a few days, though even healthy people have been sick for several weeks. People over 50 years old are at a higher risk of getting sick and are more likely to develop serious symptoms of WNV. In Massachusetts, there were six fatal WNV human cases identified between 2001-2005, all in individuals eighty years of age or older.

Activity of the West Nile virus zoonotic cycle varies from year to year. When a large number of infected birds and a high rate of infected mosquitoes are found in a relatively small geographic area, the risk of transmission of virus to humans will increase.

A summary of current and historical surveillance information for EEE virus and WNV in Massachusetts is available at **www.mass.gov/dph/wnv/wnv1.htm**

## III. PROGRAM GOALS

Timely and accurate information provided by the MDPH may offer an early warning of significant risk or an indication of low or limited risk of disease from WNV and EEE virus infection of humans or horses. Based on surveillance information, plans and actions to reduce risk can be developed and implemented when needed.

Specific Program Priorities

1. Testing mosquitoes, birds, horses, humans and other animals to identify EEE virus and WNV infections.
2. Tracking trends in incidence and prevalence of EEE virus and WNV infections by geographic area.
3. Estimating virus infection rates in birds and mosquitoes.
4. Stratifying areas as a function of their relative risk of human disease.
5. Conducting surveillance for human and equine disease.
6. Advising human and animal medical practitioners on the appropriate procedures for detecting and identifying infections and disease caused by mosquito-borne viruses.
7. Recommending measures to reduce disease transmission.
8. Providing information to the public on mosquito-borne diseases and disease risk, and how to take common-sense precautions to reduce the risk of infection.
9. Participating in the national Arbovirus surveillance network coordinated by the CDC.

The central purpose of the MDSP is to provide information that will guide planning and actions to reduce the risk of human disease from EEE virus and WNV. To achieve this, the main objectives are to monitor trends in EEE virus and WNV in Massachusetts; provide timely, detailed and summary information on the distribution and intensity of WNV and EEE virus in the environment; perform laboratory diagnosis of WNV and EEE cases in humans, horses and other mammals; communicate effectively with officials and the public; provide guidelines, advice and support on the activities that effectively reduce risk of disease; and provide information on the safety, anticipated benefits and potential adverse effects of proposed prevention interventions.

MDPH works cooperatively with the Massachusetts State Reclamation and Mosquito Control Board (SRMCB) and with regional mosquito control projects to identify and support the use of safe and effective mosquito control measures based on integrated pest management (IPM) principles. The application of pesticides as a means to reduce human risk is one of several methods/strategies to attain this goal.

Mosquito control projects collaborate with local boards of health in their jurisdictions to control mosquitoes. These locally authorized efforts employ a variety of targeted activities for source reduction and for adulticiding that are described in the Generic Environmental Impact Report (GEIR) on Mosquito Control in Massachusetts. Control of the vectors of EEE virus and WNV reduces nuisance mosquito populations and potential human disease risk. The GEIR report is available for viewing at: http://www.mass.gov/agr/mosquito/geir.htm.

As the risk for virus transmission increases, according to the categories outlined in the phased response tables, routine control efforts for mosquitoes conducted by the mosquito control programs will be refocused and augmented.

## IV. SURVEILLANCE

### A. Mosquito Surveillance for West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE) Virus

Surveillance of mosquitoes for arboviruses is the core function of the MDSP. Monitoring mosquitoes for the presence of virus provides a direct estimate of risk to humans. Massachusetts has a long-term field surveillance program that was initiated in 1957 for EEE virus and was modified in 2000 to include WNV surveillance. The extensive experience in Massachusetts with surveillance for mosquito-borne disease provides expertise and capacity to guide risk reduction efforts. The MDSP uses a comprehensive and flexible strategy that modifies certain surveillance activities in response to trends in disease risk.

**1. Fixed and Long-Term Trap Sites:** MDSP collects mosquitoes from areas where there was previous-year activity, and from long-term trap sites maintained in the EEE virus high-risk areas of southeastern and eastern Massachusetts (Figure 1). Trapping of gravid mosquitoes for testing of WNV is conducted by both mosquito control projects and MDPH staff at various locations throughout the state during the arbovirus season. At the State Laboratory, samples (pools) of trapped mosquito collections are assayed for WNV and EEE virus. Test results of routine mosquito collections are available within 24-48 hours. Fixed and long-term trap sites provide the best baseline information for detecting trends in mosquito abundance and virus prevalence and for estimating the relative risk of human infection from EEE virus and WNV.

**2. Supplemental Trap Sites:** When EEE virus or WNV activity, or increased WNV bird deaths, are detected in an area, additional trap sites and/or trap types are used to obtain more information regarding the intensity of virus activity in mosquitoes. The following risk indicators may result in the implementation of more intensive mosquito trapping: 1) virus isolations in mosquitoes; 2) human or equine cases; 3) increasing and significant numbers of bird deaths

associated with WNV; and, 4) emergence of large numbers of human biting mosquitoes in an area with a high rate of virus activity.

**3. Mosquito Control Project Trap Sites:** Massachusetts mosquito control projects, which are organized under the SRMCB, located within Department of Agricultural Resources, collaborate closely with the MDSP. The mosquito control projects employ comprehensive, integrated mosquito management (IMM) programs based on integrated pest management (IPM) principles. These management principles are described in the Generic Environmental Impact Report (GEIR) on Mosquito Control in Massachusetts.

The IMM program uses a variety of available control strategies to impact mosquito abundance. Monitoring mosquito abundance and reduction is accomplished through various surveillance methods including but not limited to larval dip counts, the use of light/ CO2 baited traps and gravid traps.

## B. Avian surveillance: West Nile virus (WNV) and eastern equine encephalitis virus (EEE virus)

### 1. Dead Bird Reports

Because WNV causes death in certain kinds of birds, and the mortality rate from infection for the American crow is high, we expect that dead birds, especially crows, will sometimes be the first warning of WNV activity in an area. The association of Corvid deaths and WNV activity has been well-established. The MDSP tracks dead bird reports provided by local and state officials, and from the public. MDSP will request that some of the dead birds, primarily crows and blue jays, be submitted for testing, and will provide a pickup service for designated regional repositories to assist local communities in the transport of specimens to MDPH.

MDSP will record and analyze dead bird reports, which will be used to identify areas for intensified surveillance of WNV activity including bird testing, and mosquito trapping. Reports of dead birds are taken via a toll-free telephone number at MDPH (866 MASS WNV, or 866-627-7968). These reports are summarized daily and provided to local health agents, the public and the media via a public website (**www.mass.gov/dph/wnv/wnv1.htm**.) Birds that are infected with EEE virus generally survive the viremia, making dead bird EEE virus monitoring impractical. MDSP monitors dead bird reports as part of WNV surveillance only.

### 2. Laboratory testing of dead wild birds for West Nile virus (WNV) and eastern equine encephalitis virus (EEE virus).

The MDSP will collect and test dead birds, primarily crows and blue jays, for WNV. Routine testing is generally completed within 24-48 hours. Confirmatory testing may take approximately four working days. MDSP does not routinely test dead birds for EEE virus. Ongoing evaluation of reports of dead birds may indicate the need for increased testing of birds and/or mosquitoes to better assess virus transmission among the bird and mosquito populations at particular times throughout the season.

All bird deaths should be reported to the MDSP on the toll-free telephone line (866 MASS WNV, or 866-627-7968), which may be used by local officials and the public. At the time of the report, information on the location and type of bird will be collected and entered into a surveillance database. The caller will be informed if the reported bird is to be tested, and arrangements will made for pickup and delivery if needed. Otherwise the caller will be informed of proper disposal procedures for the dead bird.

Once WNV infection of a bird population has been established by confirmation of two WNV avian specimens in a town, further routine testing will discontinued. Within Boston, avian specimens are tested by neighborhoods. Following the finding of two WNV specimens, and continued bird deaths, a limited sample of dead birds may be tested to confirm that additional bird deaths are the result of WNV infection.

**3. Laboratory testing of live birds for infection.**

The MDSP may capture, bleed and release birds during the season to collect supplemental information about virus activity in an area where infections in birds are increasing.

## C. Equine surveillance: West Nile virus (WNV) and eastern equine encephalitis(EEE) Virus

**Testing horses for WNV and EEE virus:**
Specimens from horses and other domestic animals that have severe neurological disease suspected of being caused by EEE virus or WNV infection are tested at the State Laboratory Institute. Confirmatory testing may take up to nine working days. Massachusetts' veterinarians, the state Department of Agricultural Resources, USDA and Tufts University School of Veterinary Medicine collaborate with the MDSP to identify and report suspect equine cases. In addition, animal blood samples from other sources such as zoos, horse stables or wild animals may be tested. Current information on WNV and EEE virus infections in horses along with clinical specimen submission procedures are disseminated to large animal veterinarians, stable owners, and other populations as needed, through mailings and postings on the MDPH Arbovirus website at www.mass.gov/dph/wnv/wnv1.htm. Many horses are immunized against infection with WNV and EEE virus with available veterinary vaccines. This is the primary means of preventing infection in horses.

## D. Human surveillance.

**1. Passive surveillance:** Specimens from clinical cases of encephalitis and meningo-encephalitis are submitted to MDPH and screened for possible causes of infection, including WNV and EEE virus. Confirmatory testing may take three to seven working days. Selected cases of other human disease, such as aseptic meningitis, may be screened, if appropriate. Current information on WNV and EEE virus infections in humans along with clinical specimen submission procedures are disseminated to physicians (infectious disease, emergency medicine and primary care), emergency room directors and hospital infection control practitioners through mailings, broadcast faxes, and postings on the MDPH Arbovirus website at www.mass.gov/dph/wnv/wnv1.htm.

**2. Active surveillance:** If surveillance data indicate a high risk of human disease, active surveillance may be instituted in targeted areas. Active surveillance involves regularly contacting local health care facilities to communicate current surveillance information, prevention strategies and specimen submission procedures. HHAN (Health and Homeland Alert Network) alerts are sent to local boards of health upon confirmation of WNV virus in any specimen; health care facilities are advised of increased risk status and corresponding need to send specimens to SLI for testing.

**3. Pesticide related surveillance:**
Outreach on pesticide illness reporting will be coordinated by the MDPH Center for Environmental Health. In the event of an aerial pesticide application, active surveillance efforts will be implemented with emergency departments and intensified outreach efforts will be made to health care providers.

## V. Prevention and control

The MDSP will provide information to guide planning and actions to reduce the risk of human disease from EEE virus and WNV. MDPH works to identify and support the use of risk reduction and disease prevention methods that are specific to causes of disease; that use the least intrusive and most appropriate prevention methods; and, that support planning and practices that encourage the appropriate use of the use of pesticides.

## Communication of information

### 1. Routine information

Prior to the beginning of the arbovirus season, general disease information and specimen submission procedures will be disseminated to local boards of health, physicians, veterinarians, animal control officers, mosquito control projects, and other agencies, as appropriate, via mailings, broadcast faxes, and postings to the MDPH Arbovirus website.

### 2. Positive EEE virus & WNV Findings in Mosquitoes, Birds, Horses and other Veterinary Specimens, and Humans

Laboratory confirmation of a human WNV or EEE case is reported to the submitting physician. Laboratory confirmation of a horse (or other veterinary specimen) with WNV or EEE virus infection is reported to the submitting veterinarian and the Department of Agricultural Resources, Bureau of Animal Health, Biosecurity and Dairy Services. All laboratory confirmed WNV or EEE virus in mosquitoes, birds, horses and other veterinary specimens, and humans are provided to the appropriate local public health officials and boards of health, MCP's and members of the State Reclamation and Mosquito Control Board(SRMCB).

Information is provided by the most timely and efficient means to all appropriate agencies. This may consist of a telephone call, email, or fax within 24 hours of confirmation of positive finding. Local boards of health may also be notified of positive results in their town, or in any towns surrounding them, via an electronic alert from the Health and Homeland Alert Network (HHAN). High level HHAN alerts will be sent to a local board of health when SLI confirms WNV or EEE virus in any specimen (bird, mosquito pool, veterinary specimen, or human) in their town. Medium level HHAN alerts will be sent to a local board of health when SLI confirms WNV or EEE virus in any specimen (bird, mosquito pool, veterinary specimen, or human) in a town neighboring their town.

At the time of notification, MDPH will encourage local Boards of Health to share the information with other local agencies and high-risk populations in their community as appropriate. MDPH provides local Boards of Health with sample press releases for their use. Depending on the circumstances, MDPH may also issue a public health alert. In addition, local boards of health are mailed weekly summaries of results from avian samples submitted and tested from their town.

Superintendents of mosquito control projects, the SRMCB and other agencies that are involved in surveillance and intervention activities are also provided results by the most efficient means, as determined by the recipient agency. The SRMCB oversees mosquito control in the Commonwealth. It has members representing the Department of Agricultural Resources (DAR), Department of Conservation and Recreation (DCR), and Department of Environmental Protection (DEP).

After all appropriate individuals and agencies have been notified, positive surveillance findings are made available to the media and general public on the MDPH Arbovirus website at www.mass.gov/dph/wnv/wnv1.htm. This website, which also includes a variety of educational materials related to preventing mosquito-borne diseases, is updated on a daily basis throughout the arbovirus season. Results are also reported to the Centers for Disease Control and Prevention Arbonet reporting system.

**3. Public Health Alerts and Media Advisories**

MDPH issues public health alerts through the media when surveillance information indicates an increased risk of human disease or if a significant surveillance event occurs (for example, the first arbovirus activity of the season). In general, alerts will include current surveillance information and emphasize prevention strategies. Alerts will be drafted in consultation with outside state and local agencies, as indicated.

## VI. Recommendations for a Phased Response to EEE virus and WNV Surveillance Data

The recommendations provided here are based on current knowledge of risk and appropriateness of available interventions to reduce the risk for human disease. Multiple factors contribute to the risk of mosquito-transmitted human disease. Decisions on risk reduction measures should be made after consideration of all surveillance information for that area at that time.

Recommendations regarding the WNV phased response plan (Table 1) incorporate several components presented in the "Massachusetts Surveillance and Response Plan for Mosquito-Borne Disease", May 2004; as well as those presented in the CDC document, "Epidemic/Epizootic West Nile virus in the United States: Guidelines for Surveillance Prevention, and Control", 3rd Revision, 2003.

Recommendations regarding the EEE virus phased response plan (Table 2) incorporate information provided in the MDPH document, "Vector Control Plan to Prevent Eastern (Equine) Encephalitis", 1991; and results of analyses of additional surveillance data collected in Massachusetts since that time.

Public awareness of what can be done to reduce risk of infection is of utmost importance. The level of EEE virus and WNV activity may occasionally present a potential for increased virus transmission to humans. Typically, risk is expected to be relatively low, and the routine precautions taken by individuals may be sufficient to avoid infection. These guidelines take into consideration the complexity of reducing risk of human disease from EEE virus and WNV infection and form a framework for decision-making. They are not a set of specific prescriptions.

**2. Phased response**

General guidelines are provided for an array of situations that are noted in the Surveillance and Response Plan Tables that follow. Specific situations must be evaluated individually and options discussed before final decisions on specific actions are made. The assessment of risk from mosquito-

borne disease is complex and many factors modify specific risk factors. MDPH works with local public health agencies, mosquito control projects, and the SRMCB to develop the most appropriate prevention activities to reduce the risk of human disease. There is no single indicator that can provide a precise measure of risk, and no single action that can assure prevention of infection.

When recommending the use of mosquito larvicides or adulticide, MDPH works cooperatively with SRMCB and with regional mosquito control projects to identify and support the use of safe and effective mosquito control measures based on integrated pest management (IPM) principles.

A. MDPH Guidance:

The MDPH Arbovirus Program will determine human risk levels as outlined in the phased response tables of this plan. Risk levels are defined for focal areas, which may incorporate one or more communities. Factors considered in determination of human risk in a focal area include mosquito habitats, human population densities, timing of current isolations of virus in mosquitoes, and the cyclical and seasonal conditions needed to pose a risk of human disease.

If the risk of an outbreak is widespread and covers multiple jurisdictions, MDPH will confer with local health agencies, SRMCB and MCPs to discuss the use of intensive mosquito control methods and determine whether measures need to be taken by the agencies to allow for and assure that the most appropriate mosquito control interventions are applied to reduce risk of human infection. These interventions may include state-funded aerial application of mosquito adulticide. Factors to be considered in making this decision include the cyclical, seasonal and biological conditions needed to present a continuing high risk of WNV or EEE human disease.

Once significant human risk has been identified in a focal area by MDPH, MDPH will coordinate with the SRMCB to determine the adulticide activities that should be considered and implemented in response by making recommendations on:

A. Appropriate pesticide(s)
B. Extent and route of treatment
C. Location of specific treatment grids.

Based on historical experience with EEE virus, MDPH has identified specific critical indicators for EEE virus and provides specific risk reduction and prevention guidance for seasons with an anticipated increased EEE risk.

B. Role of SRMCB:

The State Reclamation and Mosquito Control Board (SRMCB) advises its respective state agency commissioners of Agricultural Resources, Conservation and Recreation, and Environmental Protection on actions to reduce mosquito populations based on DPH findings and characterization of risk.

In 2006, the SRMCB created an SRMCB Mosquito Advisory Group (MAG). The MAG provides independent, authoritative scientific advice to the SRMCB evaluating and assessing data from both the DPH and mosquito control projects operating under the aegis of the State Reclamation and Mosquito Control Board.

Further, the SRMCB provides factual information about mosquito conditions and populations based on the best available current scientific information and professional judgment to summarize to the state agency Commissioners what (if any) steps are needed to reduce mosquito populations for the purpose of deciding a course of action

**3. Risk reduction and prevention guidance for seasons with anticipated increased EEE risk**

1. MDPH increases the number of public health alerts throughout the season to remind the public of the steps to take to reduce their risk of exposure to mosquitoes.

2 Field surveillance is implemented routinely in early June. Mosquito collections may be performed more frequently in years of predicted higher EEE risk.

3. Mosquito control programs increase their source reduction activities to reduce mosquito-breeding habitats and to reduce adult mosquito abundance. This may include ground and aerial larviciding.

4. After sustained findings of positive mosquito isolates, if not already in progress, adult mosquito control efforts including targeted ground adulticiding operations should be considered. The decision to use ground-based adult mosquito control will depend on critical modifying variables including the time of year, mosquito population abundance and proximity of virus activity to at-risk populations.

5. Other intensified efforts may be implemented following coordinated recommendations from MDPH and other agencies including DEP, MDAR and Department of Conservation and Recreation (DCR).

## Table 1. Guidelines for Phased Response to WNV Surveillance Data

| Risk Category | Probability of human outbreak | Definition of Risk Category for a Community or Adjacent Community (Focal Area)[1] | Recommended Response |
|---|---|---|---|
| 1 | Remote | All of the following conditions must be met:<br><br>Prior Year<br>No prior year WNV activity detected in the community or an adjacent community (focal area).<br><br>And<br><br>Current Year<br>No current surveillance findings indicating WNV activity in birds or mosquitoes in the focal area.<br><br>And<br><br>No horse or human cases. | 1. Routine avian surveillance activities: Dead bird reporting and recorded information via MDPH Public Health Information Line<br><br>2. Assess mosquito populations, monitor larval and adult mosquito density<br><br>3. Initiate source reduction; use larvicides at specific sites identified by entomologic survey. In making a decision to use larvicide consider the prevalence of *Culex* larvae, intensity of prior virus activity and weather<br><br>4. Routine, locally established nuisance control adulticide activities are implemented. No WNV specific supplemental control efforts are recommended<br><br>5. Routine collection and testing of mosquitoes.<br><br>6. Passive human and horse surveillance<br><br>7. MDPH Epidemiological staff provide educational materials and clinical specimen submission protocols to targeted groups involved in arbovirus surveillance (including local boards of health, physicians, veterinarians, animal control officers, stable owners, etc)<br><br>8. Provide educational materials to the general public on personal prevention steps and source reduction, particularly to those populations at higher risk for severe disease (e.g., the elderly)<br><br>9. Emphasize the need for schools to comply with MA requirements for filing outdoor IPM plans |

[1] Focal Area- May incorporate one or more communities. Factors considered in determination of human risk in a focal area include mosquito habitat, human population densities, timing of current isolations of virus in mosquitoes, the cyclical and seasonal conditions needed to present risk of human disease

| | | | |
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| **2** | Low | Prior Year<br><br>WNV activity in birds or mosquitoes in the community or an adjacent community (the focal area).<br><br>Or<br><br>Current Year<br>Sporadic WNV activity in birds and/or mosquitoes in the focal area. Sporadic is defined as 1-2 WNV isolates in mosquitoes for 1-2 weeks of routine collection; and one WNV positive bird.<br><br>And<br><br>No horse or human cases. | Response as in category 1, plus:<br><br>1. Increase larval control and source reduction measures.<br><br>2. Locally established routine control adulticide activities continue.<br><br>3. Expand community outreach and public education programs, particularly among high-risk populations, focused on risk potential and personal protection, emphasizing source reduction. |
| 3 | Moderate | Prior Year<br>Confirmation of one or more human or horse WNV cases; or sustained WNV activity for more than 2 weeks in mosquitoes and/or birds.<br><br>Or,<br><br>Current year<br><br>Sustained WNV activity in birds* and/or mosquitoes (< 20 isolates from routine collections).<br><br>* Continued dead bird reports following two confirmed WNV positive birds in a community or focal area.<br><br>AND<br><br>No horse or human WNV cases. | Response as in category 2, plus:<br><br>1. If not already in progress, adult mosquito control efforts including targeted ground adulticiding operations should be considered against *Culex* species. The decision to use ground-based adult mosquito control will depend on critical modifying variables including the time of year, mosquito population abundance and proximity of virus activity to at-risk populations.<br><br>2. Duly authorized local officials may request preemption of homeowner private property no-spray requests<br><br>3. Locally established routine control adulticide activities continue.<br><br>4. Supplemental mosquito trapping and testing may be performed in areas with positive WNV findings. Notify all boards of health of positive findings.<br><br>5. Public health alert sent out by MDPH in response to first WNV virus positive bird and mosquito pool detected during the season. The alert will summarize current surveillance information and emphasize personal prevention strategies.<br><br>6. HHAN (Health and Homeland Alert Network) alerts are sent to local boards of health upon confirmation of WNV in any specimen; health care facilities are advised of increased risk status and corresponding needs to send specimens to SLI for testing. |

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| 4 | High | Current Year<br><br>Sustained or increasing WNV activity in mosquitoes with mosquito isolates ≥ 20 from routine collections in a community or focal area. Sustained elevated minimum infection rates for MDPH long-term trap sites.<br><br>And/or<br><br>Confirmation of WNV in a horse at any time<br><br>And/or,<br><br>Confirmation of WNV in a human at any time | Response as in category 3, plus:<br><br>1. Intensify and expand active surveillance for human cases.<br><br>2. Intensify larviciding and/or adulticiding control measures where surveillance indicates human risk. Local, ground- based ULV applications of adulticide may be repeated as necessary to achieve adequate mosquito control. Town or city may request preemption of homeowner private property no-spray requests.<br><br>3. Local officials should evaluate all quantitative indicators including population density and time of year and may proceed with focal area aerial adulticiding.<br><br>4. MDPH will confer with local health officials, SRMCB & Mosquito Control Projects to determine if the risk of disease transmission threatens to cause multiple human cases and warrants classification as level 5.<br><br>5. Intensify public education on personal protection measures including avoiding outdoor activity during peak mosquito hours, wearing appropriate clothing, using repellents and source reduction.<br>a. Utilize multimedia messages including public health alerts from MDPH, press releases from local boards of health, local newspaper articles, cable channel interviews, etc.<br>b. Encourage local boards of health to actively seek out high-risk populations in their communities (nursing homes, schools, etc.) and educate them on personal protection<br>d. Advisory information on pesticides provided by MDPH Center for Environmental Health.<br>e. Urge towns and schools to consider rescheduling outdoor events. |

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| 5 | Critical | Current Year<br><br>More than 1 confirmed human case in a community or focal area.<br><br>Or<br><br>Multiple quantitative measures indicating critical risk of human infection (e.g. early season positive surveillance indicators, and sustained elevated field mosquito infection rates, and horse or mammal cases indicating escalating epizootic activity) | Response as in category 4, plus:<br><br>1. The MDPH Arbovirus Program will determine human risk levels as outlined in this plan. If risk of outbreak is widespread and covers multiple jurisdictions, MDPH will confer with local health agencies, SRMCB and Mosquito Control Projects to discuss the use of intensive mosquito control methods and determine if measures need to be taken by the agencies to allow for and assure that the most appropriate mosquito control interventions are applied to reduce risk of human infection. These interventions may include state-funded aerial application of mosquito adulticide<br><br>Factors to be considered in making this decision include the cyclical, seasonal and biological conditions needed to present a continuing high risk of WNV human disease.<br><br>Once critical human risk has been identified, the SRMCB will determine the adulticide activities that should be implemented in response to identified risk by making recommendations on:<br><br>A. Appropriate pesticide<br>B. Extent and route of treatment<br>C. Targeted treatment areas<br><br>2. MDPH Center for Environmental Health (CEH) will initiate active surveillance via emergency departments and with health care providers only if aerial spraying commences.<br><br>3. MDPH will designate high-risk areas where individual no-spray requests may be preempted by local and state officials based on this risk level. Aerial adulticiding will override no-spray requests. If this becomes necessary, the public will be notified via state, local and media communications.<br><br>4. MDPH recommends restriction of group outdoor activities, during peak mosquito activity hours, in areas of intensive virus activity.<br><br>5. MDPH will communicate with health care providers in the affected area regarding surveillance findings and encourage prompt reporting of all suspect cases |

## Table 2. Guidelines for Phased Response to EEE virus Surveillance Data

| Risk Category | Probability of human outbreak | Definition of Risk Category for a Community or Adjacent Community (Focal Area)[2] | Recommended Response |
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| 1 | Remote | All of the following conditions must be met:<br><br><u>Prior Year</u><br>No EEE virus activity detected in a community or adjacent community (focal area).<br><br>AND<br><br><u>Current Year</u><br>Limited or sporadic EEE virus activity in mosquitoes after August 1. Virus activity is considered to be limited or sporadic when no more than 1-2 isolates in *Cs. melanura* are found within 2 weeks of routine collections.<br><br>AND<br><br>No horse or human EEE cases. | 1. Routine surveillance activities.<br><br>2. Assess mosquito populations, monitor larval and adult mosquito density.<br><br>3. Initiate source reduction; use larvicides at specific sites identified by entomologic survey and targeted at the likely amplifying bridge vector species. In making a decision to use larvicide consider the prevalence of Culiseta larvae, intensity of prior virus activity, and weather.<br><br>4. Provide educational materials to the general public on personal prevention steps and emphasizing residential source reduction<br><br>5. Emphasize need for schools to comply with MA requirements for filing outdoor IPM plans<br><br>6. Locally established routine control adulticide activities are implemented. No EEE virus-specific supplemental control efforts are recommended<br><br>7. Routine collection and testing of mosquitoes.<br><br>8. Passive human and horse surveillance<br><br>9. MDPH Epidemiological staff provide educational materials and clinical specimen submission protocols to targeted groups involved in arbovirus surveillance (including local boards of health, physicians, veterinarians, animal control officers, stable owners, etc. |

[2] Focal Area- May incorporate one or more communities. Factors considered in the determination of human risk in a focal area include: mosquito habitat, human population densities, timing of current isolations of virus in mosquitoes, and the cyclical nature of human EEE outbreaks, current weather and seasonal conditions needed to present risk of human disease.

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| **2** | Low | Prior Year<br>EEE virus activity in mosquitoes in the prior year in the community or focal area.<br><br>OR<br><br>Current Year<br>Sporadic EEE Cs. melanura mosquito activity in the community or focal area between July 1-July31. Virus activity is considered to be limited or sporadic when no more than 1-2 isolates in *Cs. melanura* are found within 2 weeks as a result of routine collections.<br><br>AND<br><br>No horse or human cases. | Response as in category 1, plus:<br><br>1. Increase larval control and source reduction measures.<br><br>2. Routine, locally established nuisance control adulticide activities continue.<br><br>3. Expand community outreach and public education programs, particularly among high-risk populations, focused on risk potential and personal protection, emphasizing source reduction. |
| 3 | Moderate | Prior Year<br>Confirmation of one (or more) human EEE cases in the community or focal area; or 1 or more EEE horse case(s); or sustained EEE virus activity in mosquitoes.<br>Virus activity is considered to be sustained when isolates are found over 3 consecutive weeks.<br><br>Or,<br><br>Current year<br><br>No horse or human EEE cases in current year.<br><br>AND<br><br>Total EEEV isolates in *Cs. melanura* found after July 1 as a result of routine collections are between 10-15 in the community or focal area.<br><br>Or<br><br>A single EEEV isolate from mosquitoes likely to bite humans (bridge vector species)<br><br>Or<br><br>A single EEEV isolate in mosquitoes of any species, prior to July 1. | Response as in category 2, plus:<br><br>1. Intensify larviciding and/or adulticiding control measures where surveillance indicates human risk. Local, ground based ULV applications may be repeated as necessary to achieve adequate mosquito control. Town or city may request preemption of homeowner private property no-spray requests.<br><br>2. Routine, locally established nuisance control adulticide activities continue.<br><br>3. Supplemental mosquito trapping and testing in areas with positive EEEV findings. Notify all boards of health of positive findings.<br><br>4. Public health alert sent out by MDPH in response to first pool of EEE virus positive mammal-biting mosquitoes detected during the season. The alert will summarize current surveillance information and emphasize personal prevention strategies.<br><br>5. HHAN (Health and Homeland Alert Network) alerts are sent to local boards of health upon confirmation of EEE virus in any specimen; health care facilities are advised of increased risk status and corresponding need to send specimens to SLI for testing. |

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| 4 | High | Current Year<br><br>Total EEEV mosquito isolates numbering more than 15 from routine collections with sustained or increasing activity in the community or focal area. Sustained elevated weekly mosquito minimum infection rates. Virus activity is considered to be sustained when isolates are found over 3 consecutive weeks.<br><br>And/or<br><br>Isolation of EEEV in more than 1 pool of bridge vector mosquitoes<br><br>And/or<br><br>Confirmation of EEE in a horse at any time<br><br>And/or<br><br>Confirmation of EEE in a human at any time | Response as in category 3, plus:<br><br>1. Intensify and expand active surveillance for human cases.<br><br>2. Local officials should evaluate all quantitative indicators mosquito including population density and time of year and may proceed with focal area aerial adulticiding.<br><br>3. MDPH will confer with local health officials, SRMCB and Mosquito Control Projects to determine if the risk of disease transmission threatens to cause multiple human cases and warrant classification as level 5.<br><br>4. Intensify public education on personal protection measures including avoiding outdoor activity during peak mosquito hours, wearing appropriate clothing, using repellents and source reduction.<br>a. Utilize multimedia messages including public health alerts from MDPH, press releases from local boards of health, local newspaper articles or cable channel interviews, etc<br>b. Encourage local boards of health to actively seek out high-risk populations in their own communities (nursing homes, schools, etc.) and educate them on personal protection<br>d. Increased advisory information on pesticides provided by MDPH CEH<br>e. Urge towns/schools consider rescheduling outdoor events. |

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| 5 | Critical | <u>Current Year</u><br><br>More than 1 confirmed human EEE case<br><br>Or<br><br>Multiple EEE horse cases<br><br>Or<br><br>Multiple quantitative measures indicating critical risk of human infection (e.g. early season positive surveillance indicators, and sustained high mosquito infection rates, and horse or mammal case indicating escalating epizootic activity) | Response as in category 4, plus:<br><br>1. The MDPH Arbovirus Program will determine human risk levels as outlined in this plan. If risk of outbreak is widespread and covers multiple jurisdictions, MDPH will confer with local health agencies, SRMCB and Mosquito Control Projects to discuss the use of intensive mosquito control methods and determine if measures need to be taken by the agencies to allow for and assure that the most appropriate mosquito control interventions are applied to reduce risk of human infection. These interventions may include state-funded aerial application of mosquito adulticide.<br><br>Factors to be considered in making this decision include the cyclical, seasonal and biological conditions needed to present a continuing high risk of EEE human disease.<br><br>Once critical human risk has been identified, the SRMCB will determine the adulticide activities that should be implemented in response to identified risk by making recommendations on:<br><br>A. Appropriate pesticide<br>B. Extent and route of treatment<br>C. Targeted treatment areas<br><br>2. MDPH Center for Environmental Health (CEH) will initiate active surveillance via emergency departments and with health care provides only if aerial spraying commences.<br><br>3. MDPH will designate high-risk areas where individual no spray requests may be preempted by local and state officials based on this risk level. Aerial adulticiding will override no-spray requests.<br><br>If this becomes necessary, notification will be given to the public including those who have opted out.<br><br>4. MDPH recommends restriction of group outdoor activities, during peak mosquito activity hours, in areas of intensive virus activity.<br><br>5. MDPH will communicate with health care providers in the affected area regarding surveillance findings and encourage prompt reporting of all suspect cases. |

Figure 1: Location of MDPH EEE virus Mosquito Trap Sites